Random Organization(New Frontiers in Colloidal Physics : A Bridge between Micro- and Macroscopic Concepts in Soft Matter)

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Random Organization

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A simple model is introduced to describe the transition from reversible to irreversible behavior recently observed in experiments on periodically sheared particle suspensions. In the model, particles that collide under simulated shear flow are given small random displacements to mimic the irreversible particle movements observed in experiment. The model exhibits two regimes: at low particle density, the random displacements lead to increased organization until a configuration develops where particles never collide and random motion ceases. At high density, the collisions continue indefinitely and particles diffuse. A sharp transition with diverging relaxation time separates the two regimes. New dynamical experiments exhibit remarkable agreement with this simple model. The model illustrates a formerly unknown consequence of irreversible interactions and provides a natural selection mechanism for evolving systems from particle flow to biology. More generally, the model and experiments reveal how driven dynamical systems can self-organize to find dynamically quiescent (absorbing) states through purely random non-directed dynamics.